

Chilean conservation of biodiversity in the context of Latin America

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Biodiversity and its trends in Latin America

Latin America represents approximately 15% of the world's landmass, containing more than 8.5% of the global human population. Two biogeographic realms represent the region: the Nearctic, containing most of Mexico, and the Neotropical, enclosing the countries of Central America, the Caribbean, and South America.

Latin American is rich in biodiversity at the global level, and a number of Latin American ecoregions are globally outstanding (Dinerstein et al. 1995). The tropical area includes almost 40% of the world's floral species, and South America registers 32% of global avifauna. Latin America also contains a variety of ecosystems: dry lands (Chile's Atacama Desert), humid territories (Colombia's Choco forests), immense tropical forests, the most extensive mountain range in the world (the South American Andes), vast coastal-marine areas, and very old and stable environments, such as the Orinoco, the Amazon, and Patagonia (International Council of Bird Preservation 1992).

Although some Latin American countries still have large, pristine territories, most suffer from severe deterioration, in which biodiversity is seriously threatened. The

annual rate of deforestation reaches 1.2% in Central America and Mexico, 1.7% in the Caribbean, and 0.5% in South America (Food and Agriculture Organization 1999). For the period 1990–2000, the Food and Agriculture Organization of the United Nations (2001) estimated net annual forest area loss to be about 10 million acres (4 million ha) in South America, and future perspectives are pessimistic. The Food and Agriculture Organization (2000) predicts that in the next five years Latin America could experience an annual transformation rate of more than 12 million acres (5 million ha) of virgin forests to agriculture and livestock production. Many countries have adopted this development pattern without thorough consideration of land-use capacity or environmental deterioration.

Facing this situation, protected areas play an important role in preserving biological diversity and minimizing

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fragmentation of natural habitat (Brandon et al. 1998). Although these areas do not fully guarantee the conservation of biodiversity, they constitute an overwhelming con-

tribution to maintaining unique and representative natural resources and sustainable use of resources compatible with preservation objectives (table 1, page 14).



Chile in the context of Latin America

As with the rest of Latin America, human activities threaten Chile's biodiversity. The illicit clearing of natural forests, habitat destruction and hunting of wildlife, overgrazing of grasslands, overexploitation of fishing resources, and inappropriate agricultural practices are significant examples. In addition, during the 2001–2002 season, unusual forest fires affected more than 172,000 acres (70,000 ha) (San Martín 2002), causing significant damage to Tolhuaca National Park and Malleco National Reserve. Additional environmental deterioration is the consequence of global phenomena such as depletion of the ozone layer and global warming (greenhouse effect). El Niño–Southern Oscillation, another global phenomenon, also affects biodiversity.

Origins of protected areas in Chile

The conservationist movement in Chile is not new, particularly with regard to forest protection. In 1859 one of the first legal conservation-oriented instruments was passed, regulating the cutting of Alerce (*Fitzroya cupressoides*) in the fiscal lands of two communes of southern Chile. Later, in 1872 (the same year Yellowstone National Park was established in the United States) the cutting of forests on high slopes and near water resources was also regulated, and in some cases prohibited, both on public and private lands (Gallardo 2002).

The first mention of protected areas in Chilean legislation occurred in 1879. In that year, a strip 6.2 miles (10 km) wide in the Andes Mountains, and another strip 1.6 miles (1.0 km) wide in the Coastal Range, between 38° S and 42° S latitude, were classified as national reserves.

Table 1. Protected areas of Latin America

Country	National area in acres (ha)		Total protected area in acres (ha)		Protected area as % of national area	% of total protected area in Latin America
Argentina	686,099,086	(277,664,300)	36,131,114	(14,622,262)	5.27	9.16
Bolivia	271,454,164	(109,857,500)	26,691,250	(10,801,949)	9.83	6.77
Brazil	2,103,278,478	(851,196,800)	80,267,069	(32,484,083)	3.82	20.34
Chile	187,038,053	(75,694,300)	34,898,871	(14,123,573)	18.66	8.85
Colombia	281,420,064	(113,890,700)	24,210,818	(9,798,118)	8.60	6.14
Costa Rica	12,576,970	(5,089,900)	3,128,428	(1,266,075)	24.87	0.79
Cuba	28,298,493	(11,452,400)	16,115,038	(6,521,756)	56.95	4.08
Ecuador	112,553,002	(45,550,200)	28,672,990	(11,603,959)	25.48	7.27
El Salvador	5,155,671	(2,086,500)	12,903	(5,222)	0.25	<0.01
Guatemala	26,905,856	(10,888,800)	5,134,080	(2,077,762)	19.08	1.30
Honduras	27,696,318	(11,208,700)	4,655,888	(1,884,238)	16.81	1.18
Mexico	487,362,244	(197,235,500)	27,602,061	(11,170,554)	5.66	7.00
Nicaragua	36,571,535	(14,800,500)	5,340,746	(2,161,400)	14.60	1.35
Panama	19,046,207	(7,708,000)	4,382,325	(1,773,527)	23.01	1.11
Paraguay	100,506,548	(40,675,000)	3,674,117	(1,486,915)	3.66	0.93
Peru	317,572,276	(128,521,500)	16,852,755	(6,820,310)	5.31	4.27
Dominican Republic	11,969,607	(4,844,100)	3,001,465	(1,214,693)	25.08	0.76
Uruguay	46,188,535	(18,692,500)	82,871	(33,538)	0.18	0.02
Venezuela	225,363,726	(91,204,700)	73,718,599	(29,833,917)	32.71	18.68
Total	4,987,056,833	(2,018,261,900)	394,573,388	(159,683,851)	N/A	100.00

Sources: Ministry of the Environment of Colombia (1998) and National Forestry Corporation (2003), updated for Chile.

The first protected area in Chile was established in 1907: the Malleco Forest Reserve. This initiative was a response to the government's commercial interest in forest products and the resulting serious forest depletion, in order to create more land for agriculture and cattle raising (Oltremari and Faharenkrog 1979, Oltremari and Jackson 1985).

Since the 1930s the government has initiated a strong policy toward the establishment and management of protected areas, as a system composed of different management categories: national parks, national reserves, and natural monuments, administered by the National Forestry Corporation, under the Ministry of Agriculture. Nevertheless, protected areas as a system still did not have legal support until 1984 when law 18.362 established this system.

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Characterization of Chile's protected areas

The influence of past glaciation on Chile's territory has not allowed the high levels of biodiversity that are found in more tropical countries. Nevertheless, Chile's isolated conditions have facilitated the evolution of endemic species of flora and fauna, giving special value to Chile's natural patrimony. In addition, Chile has an important diversity of ecosystems, including the desert of Atacama, wetlands of the Andes high plateau, oceanic islands, shrublands of the central and south-central region (fig. 1), rain forests, and the southern ice fields. According to the National Forestry Corporation (1999), 75% of the protected-area system includes a nearly equal representation of native forest, wetlands, and permanent snow and glaciers. The system also contains almost 30% of all of Chile's natural forests. This protected-area system is



Figure 1. Shrublands are poorly represented in Chilean protected areas. Río de Los Cipreses National Reserve, in region VI (see fig. 3, page 16), protects this ecosystem type.

Chile's most significant biodiversity conservation initiative, as it represents almost 19% of the total national area (tables 1 and 2; fig. 2).

The protected areas are spread throughout the country with a notable concentration in the southern "austral" region (table 3 and fig. 3, page 16). This distribution is explained by the original motivation for establishing protected areas: scenic beauty. These areas were long associated with the conservation of scenic forests, lakes, and mountains concentrated here. This original motivation has evolved in the last few decades, to the point where biodiversity conservation has become much more important. In fact, the most recently created protected areas are located in the north and north-central parts of the country, containing arid and semi-arid environments that formerly were considered less important in terms of biodiversity.

Table 2. Management categories and size of Chilean protected areas

Management categories	Number	Area in acres (ha)	
National parks	31	21,542,525	(8,718,260)
National reserves	48	13,312,165	(5,387,433)
National monuments	15	44,181	(17,880)
Total	94	34,898,871	(14,123,573)

Source: National Forestry Corporation (2003).



Figure 2. Evergreen forests associated with watershed systems are well-represented natural environments in southern Chilean protected areas. This natural environment, located in region X (see fig. 3), hosts several *Nothofagus* species and is classified as globally outstanding but vulnerable in Latin America.



Protected areas in Chile: strengths

The main strengths of Chile's protected-areas system are its longevity (for almost a century), areal extent, and diversity (fig. 4). The long-lived conservationist movement in Chile helped maintain biological diversity in protected areas. Because of patrolling activities, threats to biodiversity in protected areas are less significant than on private lands (Naranjo 1993), except for the recent increase in forest fires. Environmental legislation passed in 1993 also contributed to regulation of development activities in the protected areas (Gallardo 2002).

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The protected-area system has undergone reclassification and re-delimitation, which is also considered an important strength. In the 1980s investigators carried out rigorous studies to better classify those areas whose original management category was not correctly applied (Oltremari et al. 1981).

During this period, improvements were made to the boundaries of several protected areas. For example, some areas included private and degraded lands, and had excluded adjacent public lands of high biological value. During this process the system was reordered using scientific and technical criteria.

Table 3. Geographical localization of protected areas in Chile

Location	% of the number	% of the area
North and central-north (regions I–V)	24.9	8.2
Central (metropolitan region)	2.2	0.1
Central-south (regions VI–VIII)	15.2	1.0
South (regions IX–X)	26.1	7.0
Austral (regions XI–XII)	31.6	83.7

Source: National Forestry Corporation (2003).

Figure 3 (left). Chilean protected areas comprise about 9% of the country's land area. Protected areas that are 49,420 acres (20,000 ha) or larger are shown in dark gray; open triangles represent protected areas less than 49,420 acres (20,000 ha). The Roman numerals on the map designate Chilean administrative regions that are like states in the United States of America, although Chile does not have a federal government.

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Figure 4. Landscape diversity is an outstanding feature of several national parks in Chile. For example, Villarrica National Park, in region IX (see fig. 3), hosts the active Villarrica Volcano (9,338 ft; 2,847 m). PHOTO BY AIDA BALDINI

Protected areas in Chile: weaknesses

Chile's protected-area system still endures some weaknesses, which present challenges for the future. These can be classified into two key categories: (1) inadequate coverage of Chile's biodiversity and representation of its major ecosystems, and (2) institutional and legal constraints.

Several indicators demonstrate the need to improve biodiversity coverage and representation of major ecosystems. Some of the forest types are represented very poorly (fig. 5). Such is the case of the forest type *Nothofagus obliqua*-*Nothofagus glauca*, which is represented in only 0.5% of their distribution, and the shrublands of central Chile and the forest type *Nothofagus obliqua*-*Nothofagus alpine*-*Nothofagus dombeyi*, represented in 2% and 2.8%, respectively.

This weakness is also notable when considering the representation of Chile's vegetative associations (Benoit 1991). The protected-area system only preserves 54 of the 83 vegetative associations described for the country (36% lack representation). Additionally, 264 species of flora and fauna are considered threatened (National Forestry Corporation 1987, National Forestry Corporation 1989).

However, several recent initiatives reduce these deficiencies. The National Forestry Corporation and the University of Concepción (1993) carried out a comprehensive study to identify priority sites for conservation of biodiversity not properly represented in the system. Results of this activity have been very useful in guiding the establishment of new protected areas during the last decade (fig. 6).

Certain institutional and legal constraints also are recognized weaknesses. The lack of personnel is evident: only 450 park rangers (called "guards" in Latin America), including both seasonal and permanent personnel, manage and protect the total amount of protected areas—approximately one guard for each 74,130 acres (30,000 ha). However, this figure should only be considered as an indicative reference, as the real need for guards should be associated with the extent of management programs, number of visitors, and accessibility of the areas. As an

example, in 2001, protected areas located in the most southern region of Chile (regions XI and XII, see table 3 and fig. 3) received only 18% of the total visitors to the national system, although 84% of Chile's protected area is located there.

Chile, as with many Latin American countries, has insufficient funding to satisfy the needs of protected areas. The annual budget for the whole system is about \$5 million, including salaries, goods and services, and capital expenditures. Capital expenditures are considered the major constraint as they have only reached an average of 10 to 15% of the annual budget during the last decade.

Chile lacks systematized legislation to support the national system of protected areas. The laws on protected areas are dispersed and legal contradictions are frequent. While some laws promote the establishment and management of protected areas, others are focused on enhancing traditional productive activities incompatible with environmental protection within protected areas. Mining is a primary example. In this context, the need to improve legislation, increase institutional capacities, and search for innovative financing mechanisms are the major challenges for Chile's protected areas.

New perspective and conclusions

As a fundamental criterion for the establishment of protected areas, Latin American countries are using the conservation of representative samples of biological diversity. In this context, national parks and other protected areas are achieving increasing relevance and importance. Moreover, the national institutions administering protected areas, and society as a whole, are delegating a more complex role to these areas. Several countries now

plan protected-area systems as part of the surrounding landscape through a bioregional planning process. By means of this approach, strict protected areas, like national parks, are considered as core zones linked by buffer zones and biological corridors.

This new perspective involves serious challenges. The active participation of the private sector is essential in the



Figure 5. The Sclerophyll Forest Ecologic Subregion is one of the most seriously threatened ecosystem types in Chile. The subregion is dominated by the espino (*Acacia caven*), and other sclerophyllous shrubs, such as *Lithraea caustica*, *Quillaja saponaria*, and *Cryptocaria alba*. The espino is a native species spread by the introduction of domestic livestock and clearing of the matorral for firewood.



Figure 6. Mountain Sclerophyll Forest of central Chile risks extinction because of overgrazing and agricultural activities. Preserving this forest type is a major priority in establishing new protected areas.



operation of some management activities, such as eco-tourism, inside and outside protected areas. Society also can play an important role through the establishment of private protected areas that provide vital connections between and surrounding the areas.

As a consequence, governmental institutions administering protected areas need to strengthen their normative role regarding the participation of other interested organizations. The coordinated efforts of public institutions with local communities, the private sector, and the growing number of nongovernmental organizations are crucial. The government cannot delegate the responsibility for guaranteeing environmental protection. Rather it must assume a protagonist role in coordinating alliances among interested and affected stakeholders.

At present in Latin America, society in general is more sensitive to environmental conservation than in past decades, and national parks and other protected areas are now receiving substantial attention and support. The cultural values of the indigenous and rural communities associated with protected areas are also receiving important attention. As a result, a new challenge has arisen: democratizing the planning and management of protected areas to improve management activities. Participatory planning is increasingly being used to reduce conflicts between environmental protection and traditional land use, and to promote viable solutions for the problems of poverty of local communities.

As with other Latin American countries, Chile is facing the new challenges of improving management of existing protected areas, and of increasing the coverage and representation of those environments not yet well protected. Overall, Chile needs to develop innovative financing mechanisms to enhance institutional capabilities to manage protected areas and to create legislation that will guarantee the stability of decisions that conserve biological diversity.

References

- Benoit, I. 1991. Current covering of the national system of public protected areas. National Forestry Corporation, Santiago, Chile (in Spanish).
- Brandon, K., K. H. Redford, and S. E. Sanderson. 1998. Introduction. Pages 1–23 in K. Brandon, K. H. Redford, and S. E. Sanderson, editors. *Parks in peril: people, politics and protected areas*. Island Press, Washington, D.C.
- Dinerstein, E., D. M. Olson, D. J. Graham, A. L. Webster, S. A. Primm, M. P. Bookbinder, and G. Ledec. 1995. A conservation assessment of the terrestrial ecoregions of Latin America and the Caribbean. The World Bank and the World Wildlife Fund, Washington, D.C.
- Food and Agriculture Organization of the United Nations (FAO). 1999. *State of the world's forest*. FAO, Rome, Italy.
- Food and Agriculture Organization of the United Nations (FAO). 2000. *Forestry policies in South America*. Project GCP/RLA/127/NRT. FAO, Regional Office for Latin America and the Caribbean, Santiago, Chile (in Spanish).
- Food and Agriculture Organization of the United Nations (FAO). 2001. *State of the world's forest*. FAO, Rome, Italy.
- Gallardo, E. 2002. *Forestry legislation and wild protected areas*. Editorial CONOSUR 2000, 2 volumes, Santiago, Chile (in Spanish).
- International Council of Bird Preservation (ICBP). 1992. *Putting biodiversity on the map: priority areas for global conservation*. ICBP, Cambridge, United Kingdom.
- Ministry of the Environment of Colombia. 1998. *Regional diagnostic and development strategies of Latin American protected areas*. First Latin American Congress of National Parks and Other Protected Areas. Ministry of the Environment of Colombia, Bogotá, Colombia (in Spanish).
- Naranjo, J. 1993. Biodiversity situation in the national system of public protected areas of Chile. National report. International workshop on policies of the national systems of protected areas on biological conservation. National Forestry Corporation, Santiago, Chile (in Spanish).
- National Forestry Corporation. 1987. *Red list of terrestrial vertebrates*. National Forestry Corporation, Santiago, Chile (in Spanish).
- National Forestry Corporation. 1989. *Red list of terrestrial flora of Chile*. National Forestry Corporation, Santiago, Chile (in Spanish).
- National Forestry Corporation. 1999. *Inventory and evaluation of native vegetation resources of Chile*. National report with environmental variables. National Forestry Corporation and National Environmental Commission, Santiago, Chile (in Spanish).
- National Forestry Corporation. 2003. *Statistics of protected areas in Chile*. National Forestry Corporation, Santiago, Chile (in Spanish).
- National Forestry Corporation and University of Concepción. 1993. *Priority sites for the conservation of biological diversity in Chile*. National Forestry Corporation and Natural Sciences and Oceanography Faculty, University of Concepción, Santiago, Chile (in Spanish).
- Oltremari, J., and E. Faharenkrog. 1979. Institutionalization of national parks in Chile. *Parks* 3(4):1–4.
- Oltremari, J., and R. Jackson. 1985. Chile's national parks: present and future. *Parks* 10(2):1–4.
- Oltremari, J., G. Paredes, and P. Real. 1981. *Methodology for the re-classification and re-delimitation of national parks and forest reserves in Chile*. Working document 25, Project CONAF/UNDP/FAO. Ministry of Agriculture, Santiago, Chile (in Spanish).
- Pauchard, A., and P. Villarroel. 2002. Protected areas in Chile: history, current status, and challenges. *Natural Areas Journal* 22:318–330.
- San Martín, R. 2002. Red alert: fire in the forest. *Chile Forests* 290:30–35 (in Spanish).

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